

Tools for estimating the magnitude of population effects to endangered species using predicted pesticide exposure concentrations, extent of overlap of species ranges with pesticide use sites, and refined toxicity data

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Abstract:

The U.S. Environmental Protection Agency (USEPA), the U.S. Fish and Wildlife Service (USFWS), and the National Marine Fisheries Service (NMFS), with assistance from the U.S. Department of Agriculture (USDA), are working together to develop an approach for evaluating risks of pesticides to species listed as threatened and endangered under the Endangered Species Act. Recently, Biological Evaluations and draft Biological Opinions were completed for the organophosphate insecticides chlorpyrifos, malathion and diazinon. In order to aid in the population-level assessment, Excel/Python based tools (called the “Terr MAGtool” and “Aqua MAGtool”) were created to integrate species exposure (*i.e.*, modeled exposure concentrations), the overlap of the species range with potential use sites, and effects data (*i.e.*, dose-response relationships) to assist in the determination of the magnitude of the effect of potential pesticide use to the species on a population scale. The tools integrate this information with available species data, including dietary items and life history information, to predict an anticipated magnitude of mortality or frequency of exceedance of sublethal effects endpoints. Probabilistic output is also reported using multiple years of overlap data and ranges of available exposure concentrations. Inputs allow for the use of multiple toxicity endpoints, allowing a range of effects data to be utilized, including those from a species sensitivity distribution (SSD) or surrogate data more closely related to a species when available. Additional options in the tool include the ability to assume a uniform or non-uniform distribution of a species within its range and the use of Hydrologic Unit Code (HUC) - 12 specific data for aquatic species or critical land attributes (*e.g.*, USGS National GAP Analysis program) for terrestrial species. Output from the tool graphically depicts the contribution of individual pesticide use layers to population-level impacts, allowing for a more refined interpretation of results and options for possible mitigation.